MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2019/2020

PPS0016 – INTRODUCTION TO PROBABILITY AND STATISTICS

(All groups)

13 MARCH 2020
9:00 AM – 11:00 AM
(2 Hours)

INSTRUCTION TO STUDENT

1. This examination paper consists of **6 pages** (including the cover page) with **5 questions only**.

2. Each question is worth **20 marks. Attempt ALL questions.**

3. A normal distribution table is provided in the appendix.

4. Please write all your answers in the Answer Booklet provided. **Show all relevant steps** to obtain maximum marks.

Question 1

Consider the following sample of highest temperatures (in Fahrenheit) of selected world cities on an October day.

62	72	66	79	83	61	85	72	64	74
71	42	38	91	66	77	90	74	63	64
68	42	62	47	62	83	71	56	39	78

a) Show **using formal methods of calculation** that the appropriate number of classes for the above data is 6 and that the appropriate class width is 9.

[4 marks]

b) Prepare a **frequency distribution table** for the data above using the template below. Use the lowest value of the data above as the lower limit of the first class.

Class limits	Class boundaries	Midpoint m	Tally	Frequency f	mf	mf	Cumulative frequency

[8 marks]

c) Estimate the **mean, mode, median** and **standard deviation** of the data based on the frequency distribution table. Round off final values to two decimal places.

[8 marks]

Continued...

Question 2

a) Two thousand randomly selected adults were asked if they think they are financially better off than their parents. The following incomplete contingency table shows the number of responses based on the education levels of the persons included in the survey and if they are financially better off, the same, or worse off than their parents.

	Less than high school (L)	High school (H)	More than high school (M)	Total
Better off (B)	140	450		1010
Same (S)			110	420
Worse off (W)	200	300		
Total	400			

i) **Copy and complete** the contingency table above. [7 marks]

ii) One adult is selected at random from these 2000 adults. Find the **probability** (rounded to 4 decimal places) that this adult is financially worse off than his parents given that he has more than high school education level. [2 marks]

iii) Determine whether the events 'Better off' and 'Less than high school' are independent or not. [5 marks]

b) Alicia's wardrobe contains a collection of distinct t-shirts of several brands, of which 10 are Zahra, 6 are Salora and 8 are Forever Thirtyone. Alicia decides to choose 3 Zahra, 2 Salora and 3 Forever Thirtyone t-shirts to be donated to charity. How many different **ways** can she make the selection? [3 marks]

c) Consider the 16-letter word 'ENTREPRENEURSHIP'. Calculate the **number of ways** the letters can be arranged if they must both start and end with the letter E. Show your final answer in **4 significant figures.** [3 marks]

Continued...

Question 3

a) A shipment of 7 units of lab equipment contains 2 defective units. The Faculty of Engineering makes a random purchase of 3 of the units. If X is the random variable that denotes the number of defective units in the purchase, **prepare a table** that shows the probability distribution of X. Then, calculate the **expected value of X** and the **variance of X**. [10 marks]

b) Suppose a continuous random variable X has a probability density function given as

$$f(x)=\begin{cases} x+1 & -1<x<0 \\ 1-x & 0\le x<1 \\ 0 & \text{elsewhere} \end{cases}$$

i) Construct the **cumulative distribution function** $F(x)$ as a piecewise-defined function. [7 marks]

ii) Find $P(-0.75<X<0.5)$. [3 marks]

Question 4

a) In a certain district, having mental health problems is determined as the reason for 75% of all college drop-outs. Find the **probability** that among the next 5 college drop-outs in this district,

i) exactly 3 resulted from mental health problems. [3 marks]

ii) at least 2 did not result from mental health problems. [4 marks]

b) At the FOE parking lot, an average of 2 cars will be victims of bird droppings on any given workday. Find the **probability** that on a 5-day work week, at least four cars become the victims of bird droppings. [5 marks]

c) The lengths of metal bars manufactured on a machine are normally distributed with a mean of 3.0 metres and a standard deviation of 0.009 metres.

i) Find the **probability** that any random metal bar manufactured has a length longer than 2.98 metres. [3 marks]

ii) The metal bars that are shorter than 2.98 metres or longer than 3.02 metres are unusable. What **percentage** of all metal bars manufactured by this machine are deemed unusable? [5 marks]

Continued...

Question 5

a) A charter bus company is advertising a singles outing on a bus that holds 60 passengers. The company has found that, on average, 10% of ticket holders do not show up for such trips. Hence, the company routinely overbooks such trips. Assume that passengers act independently of one another. If the company sells 65 tickets,

i) show that the distribution of proportion of ticket holders who show up is approximately normal. [3 marks]

ii) find the **probability** that the bus can hold all ticket holders who actually show up. [5 marks]

b) A manufacturer of packed sausages determined that, based on decades of data, each pack of sausages contains an average of 135 mg of cholesterol with a standard deviation of 8 mg. A consumer association inspector randomly selected a sample of 36 packs of sausages from the manufacturing line for inspection and testing.

i) Find the **probability** that the mean cholesterol content in the sample is less than 133 mg. [4 marks]

ii) Any pack of sausages that contains more than k mg of cholesterol is considered to have failed the inspection test. If one pack out of the sample failed the test, find the **value of k in three significant figures.** [5 marks]

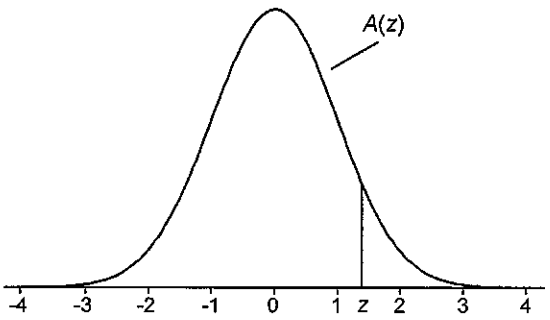
iii) Find the **percentage** of packs of sausages in the sample that has an average cholesterol content between 134 mg and 137 mg. [3 marks]

End of Paper

Appendix

TABLE A.1

Cumulative Standardized Normal Distribution



$A(z)$ is the integral of the standardized normal distribution from $-\infty$ to z (in other words, the area under the curve to the left of z). It gives the probability of a normal random variable not being more than z standard deviations above its mean. Values of z of particular importance:

z	$A(z)$	
1.645	0.9500	Lower limit of right 5% tail
1.960	0.9750	Lower limit of right 2.5% tail
2.326	0.9900	Lower limit of right 1% tail
2.576	0.9950	Lower limit of right 0.5% tail
3.090	0.9990	Lower limit of right 0.1% tail
3.291	0.9995	Lower limit of right 0.05% tail

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998
3.5	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998
3.6	0.9998	0.9998	0.9999							